

CLAIMS

What is claimed is:

1. A networked and field addressable distributed antenna system comprising a large field megacell coverage area, at least a portion of which is partitioned into a plurality of short range picocells, wherein each of the picocells is serviced by a secondary base repeater node operative to receive an information signal from a neighboring secondary base repeater node or from an originating information signal source, and to receive a command signal including a direction command from an originating base station having a command signal transmitter, and to transmit the information signal in at least one of three directions for receipt by local users or by a neighboring secondary base repeater node positioned along the direction to which the information signal was transmitted, the direction in which the information signal is transmitted being determined by the direction command of the command signal, wherein the secondary base repeater nodes are positioned such that they re-broadcast the information signal to neighboring secondary base repeater nodes in a tree structure.
2. A networked and field addressable distributed antenna system as set forth in claim 1, wherein the secondary base repeater nodes are positioned such that they re-broadcast the information signal in a fan-out tree structure.
3. A networked and field addressable distributed antenna system as set forth in claim 2, wherein the megacell has an input end and an output end, and wherein the

information signal may be propagated from secondary base repeater node to secondary base repeater node from an information signal source at the input end to an information signal output end receiver at the output end, with the information signal output end receiver configured to receive from a plurality of base repeater nodes at the output end of the megacell.

✓ 4. A networked and field addressable distributed antenna system as set forth in claim 3, wherein at least a portion of the secondary base repeater nodes are further configured to modify the received information signal and to re-transmit the received information signal as a modified information signal.

5. A networked and field addressable distributed antenna system as set forth in claim 3, wherein the information signal output end receiver is connected with the information source by a loop back means.

6. A networked and field addressable distributed antenna system as set forth in claim 5, wherein the loop back means is selected from the group consisting of a fiber-optic cable, a wire, and a point-to-point wireless channel.

7. A networked and field addressable distributed antenna system as set forth in claim 6, wherein at least a portion of the secondary base repeater nodes are further configured to modify the received information signal and to re-transmit the received information signal as a modified information signal.

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8. A networked and field addressable distributed antenna system as set forth in claim 7, wherein the information signal contains a call setup portion and wherein at least a portion of the secondary base repeater nodes further configured with a means
5 for receiving a call setup request from a local user including an identity of at least one second local user in the megacell, and wherein the networked and field addressable distributed antenna system further comprises a means for mapping the identity of a local user to a picocell within the megacell and providing information for generating a direction command of a command signal such that
10 the direction command causes a call to be established along a predetermined path through the megacell and the loop back means from the local user to the at least one second local user, whereby a user may transmit information to at least one other desired user within the megacell.

15 9. A networked and field addressable distributed antenna system as set forth in claim 1, wherein the direction command from the command signal includes a direction command for a plurality of secondary base repeater nodes in order to cause the secondary base repeater nodes to transmit the information signal along a predetermined path through the megacell.

20 10. A networked and field addressable distributed antenna system as set forth in claim 1, wherein the secondary base repeater nodes further comprise a command signal receiver for receiving a command signal and an information receiving antenna for

receiving the information signal from a neighboring secondary base repeater node or from an originating information signal source, an amplifier for receiving the information signal from the information receiving antenna, operative for amplifying the information signal, and an information signal transmitter for receiving the amplified information signal from the amplifier and operative in response to the command signal to transmit the information signal in a direction to at least one of three picocells for receipt by local users or by the next neighboring secondary base repeater node receiving from each picocell to which the information signal was transmitted, the direction in which the information signal is transmitted being determined by the direction command of the command signal.

11. A networked and field addressable distributed antenna system as set forth in claim 10, secondary base repeater nodes are positioned only in a desired area of coverage within the megacell such that only specified picocells representing the desired area of coverage within the megacell may receive coverage by the information signal.

12. A networked and field addressable distributed antenna system as set forth in claim 10, wherein the information signal transmitters of the secondary base repeater nodes are selected from the group consisting of sector antennas and multi-beam forming antenna arrays.

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13. A networked and field addressable distributed antenna system as set forth in claim 12, wherein the information signal transmitters of the secondary base repeater nodes are operative to transmit in at least one of three approximately 60 degree sectors, with the combined three sectors aligned to transmit over a 180 degree angular coverage region substantially opposite the information receiving antenna of the respective secondary base repeater node.

14. A networked and field addressable distributed antenna system as set forth in claim 10, wherein each picocell is coincident with a coverage range of the servicing secondary base node, with the coverage range of the associated secondary base node including an edge, and wherein a neighboring secondary base node is positioned within the coverage range of the associated secondary base node and near the edge of the coverage range of the associated secondary base node.

15. A networked and field addressable distributed antenna system as set forth in claim 14, wherein the information signal transmitters of the secondary base repeater nodes are selected from the group consisting of sector antennas and multi-beam forming antenna arrays.

16. A networked and field addressable distributed antenna system as set forth in claim 15, wherein the information signal transmitters of the secondary base repeater nodes are operative to transmit in at least one of three approximately 60 degree sectors, with the combined three sectors aligned to transmit over a 180 degree

angular coverage region substantially opposite the information receiving antenna of the respective secondary base repeater node.

17. A networked and field addressable distributed antenna system as set forth in claim

5 16, secondary base repeater nodes are selectively positioned within the megacell such that specified picocells within the megacell may receive coverage by the information signal.

18. A networked and field addressable distributed antenna system as set forth in claim

10 16, wherein the secondary base repeater nodes are positioned such that they communicate in a fan-out tree structure.

19. A networked and field addressable distributed antenna system as set forth in claim

15 18, wherein the megacell has an input end and an output end, and wherein the information signal may be propagated from secondary base repeater node to secondary base repeater node from an information signal source at the input end to an information signal output end receiver at the output end, with the information signal output end receiver configured to receive from a plurality of base repeater nodes at the output end of the megacell.

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20. A networked and field addressable distributed antenna system as set forth in claim

19, wherein at least a portion of the secondary base repeater nodes are further

configured to modify the received information signal and to re-transmit the received information signal as a modified information signal.

21. A networked and field addressable distributed antenna system as set forth in claim 19, wherein the information signal output end receiver is connected with the information source by a loop back means.

22. A networked and field addressable distributed antenna system as set forth in claim 21, wherein the loop back means is selected from the group consisting of a fiber-optic cable, a wire, and a point-to-point wireless channel.

23. A networked and field addressable distributed antenna system as set forth in claim 22, wherein at least a portion of the secondary base repeater nodes are further configured to modify the received information signal and to re-transmit the received information signal as a modified information signal.

24. A networked and field addressable distributed antenna system as set forth in claim 23, wherein the information signal contains a call setup portion and wherein at least a portion of the secondary base repeater nodes further configured with a means for receiving a call setup request from a local user including an identity of at least one second local user in the megacell, and wherein the networked and field addressable distributed antenna system further comprises a means for mapping the identity of a local user to a picocell within the megacell and

providing information for generating a direction command of a command signal
such that the direction command causes a call to be established along a
predetermined path through the megacell and the loop back means from the local
user to the at least one second local user, whereby a user may transmit
5 information at least one other desired user within the megacell.

25. A networked and field addressable distributed antenna system as set forth in claim
24, wherein the information signal uses a broadband, picocell transmission
channel and command signal uses a narrowband, megacell distribution channel.

26. A networked and field addressable distributed antenna system as set forth in claim
25, wherein the loop back means is used diagnostically to ensure correct path
setup and to check connection integrity within the megacell.

27. A secondary base repeater node for use within a networked and field addressable
distributed antenna system, the secondary base repeater node comprising:

- a. a command signal receiving antenna for receiving a command signal
including a direction command;
- b. an information receiving antenna for receiving an information signal from
a neighboring secondary base repeater node or from an information signal
source;

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- c. an amplifying means connected with the information receiving antenna for amplifying a received information signal in preparation for re-transmission;
- d. a three-directional information signal transmitting antenna for re-transmitting the amplified information signal in at least one of three directions; and
- e. a switch bank connected between the amplifying means and the three-directional information signal transmitting antenna and connected with the command signal receiver for receiving the direction command from the command signal and for selectively causing the three-directional information signal transmitting antenna to re-transmit the amplified information signal in at least one of thee directions based on the direction command.

28. A secondary base repeater node for use within a networked and field addressable distributed antenna system as set forth in claim 27, wherein the amplifying means is a multi-stage amplifier.

29. A secondary base repeater node for use within a networked and field addressable distributed antenna system as set forth in claim 27, wherein the three-directional information signal transmitting antenna is selected from the group consisting of sector antennas and multi-beam forming antenna arrays.

30. A secondary base repeater node for use within a networked and field addressable distributed antenna system as set forth in claim 29, wherein the three-directional information signal transmitting antenna is operative to transmit in at least one of three approximately 60 degree sectors, with the combined three sectors aligned to transmit over a 180 degree angular coverage region substantially opposite the information receiving antenna.

31. A secondary base repeater node for use within a networked and field addressable distributed antenna system as set forth in claim 30, wherein the information signal receiving antenna and the three-directional information signal transmitting antenna use a broadband, picocell transmission channel and command signal receiving antenna receives in a narrowband, megacell distribution channel.

32. A secondary base repeater node for use within a networked and field addressable distributed antenna system as set forth in claim 27, wherein the amplifying means comprises a common amplifier connected with the information receiving antenna for receiving and amplifying the information signal, a signal splitter for receiving the amplified information signal from the common amplifier and for splitting the amplified information signal into three portions, three branch amplifiers, with each branch amplifier connected with the signal splitter for further amplifying one of the portions of the split information signal, and wherein the switch bank includes three switches, each connected to receive and selectively pass one of the portions of the further amplified split information signal to be re-transmitted in a

direction by the three-directional information signal transmitting antenna as determined by the direction command of a command signal received in the command signal receiver.

- 5 33. A secondary base repeater node for use within a networked and field addressable distributed antenna system as set forth in claim 31, wherein the command signal receiving antenna is configured for receiving a command signal in the form of an amplitude-modulated frequency shift keyed radio frequency signal including digital direction command segments of a direction command, and wherein switch
- 10 bank includes a switching control code for each direction to which the three-directional information signal transmitting antenna transmits, and wherein the switch bank further comprises a detector, a switch register and a switch processor, with the detector connected to receive and detect the amplitude-modulated frequency shift keyed radio frequency signal to retrieve the digital code bit
- 15 direction command, with the switch register connected with the detector to receive and accumulate digital code bit direction command segments to assemble a direction command, and with the switch processor connected with the switch register to compare the received direction command with the switching control codes for the directions to which the three-directional information signal
- 20 transmitting antenna transmits and to cause a received information signal to be re-transmitted in directions for which the received direction command matches the switching control codes.

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34. A secondary base repeater node for use within a networked and field addressable distributed antenna system as set forth in claim 27, wherein the command signal receiving antenna is configured for receiving a command signal in the form of an amplitude-modulated frequency shift keyed radio frequency signal including digital code bit direction command segments of a direction command, and wherein switch bank includes a switching control code for each direction to which the three-directional information signal transmitting antenna transmits, and wherein the switch bank further comprises a detector, a switch register and a switch processor, with the detector connected to receive and detect the amplitude-modulated frequency shift keyed radio frequency signal to retrieve the digital code bit direction command, with the switch register connected with the detector to receive and accumulate digital code bit direction command segments to assemble a direction command, and with the switch processor connected with the switch register to compare the direction command with the switching control codes for the directions to which the three-directional information signal transmitting antenna transmits and to cause a received information signal to be re-transmitted in directions for which the received direction command matches the switching control codes.

35. An originating base station for use within a networked and field addressable distributed antenna system, wherein the originating base station comprises a code generating transmission unit including a direction code database including direction codes for each one of a plurality of switches controlling three-directional

information signal transmitting antennas of a plurality of secondary base repeater nodes; a processor for determining a path including a plurality of secondary base repeater nodes and for retrieving digital direction codes from the direction code database corresponding to switches controlling the three-directional information signal transmitting antennas along the path; a modulator for receiving the digital direction codes from the processor and for using an amplitude-modulation frequency shift keying scheme to modulate the digital direction codes onto a radio frequency channel to produce a command signal; a command signal transmitter for transmitting the command signal to a plurality of secondary base repeater nodes.

36. An originating base station for use within a networked and field addressable distributed antenna system as set forth in claim 35, wherein the originating base station further comprises an information source having information and an information source transmitter for transmitting an information signal including information from the information source to a plurality of secondary base repeater nodes, where the processor controls the transmission of the information signal such that information is routed through the plurality of secondary base repeater nodes in accordance with the command signals developed by the code generating transmission unit.

37. An originating base station for use within a networked and field addressable distributed antenna system as set forth in claim 36, wherein the information signal

uses a broadband, transmission picocell and command signal uses a narrowband, transmission megacell.

38. A method for distributing information to selective picocells within a megacell by using a networked and field addressable distributed antenna system comprising the steps of:

- a. receiving an information signal from an information source at a secondary base repeater node;
- b. receiving a command signal including a direction command from a command signal transmitter;
- c. determining at least one direction in which to re-transmit the received information signal from the secondary base repeater node;
- d. re-transmitting the received information signal in at least one of three directions as determined in the determining step (c) for receipt by local users or by a neighboring secondary base repeater node positioned in the direction to which the information signal was transmitted, whereby the information signal may be re-broadcast through a plurality of secondary base repeater nodes in a tree structure.

39. A method for distributing information to selective picocells within a megacell by using a networked and field addressable distributed antenna system as set forth in claim 38, further comprising the step of configuring the base repeater nodes such that they re-broadcast the information signal in a fan-out tree structure.

40. A method for distributing information to selective picocells within a megacell by using a networked and field addressable distributed antenna system, as set forth in claim 39, further comprising the step of selectively positioning the base repeater nodes such that only desired picocells within the megacell are capable of receiving the information signal.

✓ 41. A method for distributing information to selective picocells within a megacell by using a networked and field addressable distributed antenna system as set forth in claim 40, wherein the megacell has an input end and an output end, and wherein the method further comprises the step of looping back the information signal from the output end to the input end.

42. A method for distributing information to selective picocells within a megacell by using a networked and field addressable distributed antenna system as set forth in claim 41, further comprising the step of optionally modifying the received information signal at each secondary base repeater node prior the re-transmitting step (d).

43. A method for distributing information to selective picocells within a megacell by using a networked and field addressable distributed antenna system as set forth in claim 42, further comprising the step of performing a call setup between users in the megacell.

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5 44. A method for distributing information to selective picocells within a megacell by using a networked and field addressable distributed antenna system as set forth in claim 43, further comprising the step of using the looping back of the information signal for diagnostically ensuring correct path setup and for checking the path setup connection integrity within the megacell.

10 45. A method for distributing information to selective picocells within a megacell by using a networked and field addressable distributed antenna system as set forth in claim 41, further comprising the step of using the looping back of the information signal for diagnostically ensuring correct path setup and for checking the path setup connection integrity within the megacell.